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Methodology for Evaluation of Audio-Tutorial Modules in the Development of Cognitive Knowledge and Intellectual Skills in the Sensory Evaluation of Foods

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To the Graduate Council:

I am submitting herewith a thesis written by Cynthia Sharaphane English entitled "Methodology for Evaluation of Audio-Tutorial Modules in the Development of Cognitive Knowledge and Intellectual Skills in the Sensory Evaluation of Foods." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Food Science and Technology.

Betty L. Beach, Major Professor

We have read this thesis and recommend its acceptance:

Dorothy Lyon, Al Grant

Accepted for the Council:
Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

December 1973

To the Graduate Council:

I am submitting herewith a thesis written by Cynthia Sharaphane English entitled "Methodology for Evaluation of Audio-tutorial Modules in the Development of Cognitive Knowledge and Intellectual Skills in Sensory Evaluation of Foods." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Institution Administration.

Betty L Bach
Major Professor

We have read this thesis and recommend its acceptance:

Dorothy E. Lyon

Al Grant

Accepted for the Council:

Hilton A. Smith
Vice Chancellor for
Graduate Studies and Research

METHODOLOGY FOR EVALUATION OF AUDIO-TUTORIAL MODULES IN THE DEVELOPMENT OF COGNITIVE KNOWLEDGE AND INTELLECTUAL SKILLS IN SENSORY EVALUATION OF FOODS

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

Cynthia Sharaphane English

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ABSTRACT

Eighteen undergraduate students at the University of Tennessee, Knoxville, were subjects in a research study to evaluate audio-tutorial modules in the development of cognitive knowledge and intellectual skills in sensory evaluation of foods. Student opinions toward testing and teaching methods and pertinent background information were obtained by a student information sheet. Practical examinations, written examinations, and the Kelley Audiovisual Scale were completed by each subject before presentation of an independent study module, immediately following the presentation, and four weeks following the presentation.

The results indicated that the students had a positive attitude toward audiovisuals and preferred independent study and test methods with the presence of an instructor. The test scores indicated that intellectual skills increased more than cognitive knowledge and were retained longer. Therefore, audio-tutorial modules using audiovisuals may be an appropriate instructional strategy and learning experience for increasing intellectual skills.

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CHAPTER I

INTRODUCTION AND DEFINITION OF TERMS

I. INTRODUCTION

The College of Home Economics at the University of Tennessee, Knoxville initiated a Coordinated Undergraduate Program in Dietetics, Fall 1972. The four academic year program incorporates a former fifth year dietetic internship into a baccaluareate program. The Coordinated Program leads to a Bachelor of Science degree, eligibility for membership in the American Dietetic Association, and eligibility to apply for registration as a dietitian. Clinical experiences and didactic studies are integrated so that cognitive knowledge and intellectual skills are increased simultaneously. Knowledge and skills from the various areas of study are integrated to enable students to meet the entry-level competencies for dietitians.

One method of achieving this integration of knowledge and skills may be the use of audiovisual independent study materials. Independent study and self-instructional materials have been used successfully in programs similar to the Coordinated Program in Dietetics. The College of Human Medicine at Michigan State University introduced a library

of self-instructional materials to make time a variable, to provide opportunities to review and/or access to desired materials, and to provide variety for students with varying learning styles (Fiel and Ways, 1972). Evanston Hospital School of Nursing developed a similar program to accommodate students with varying learning speeds and to better coordinate clinical practice with class content (Wittkope, 1972). Since the goals of these programs are similar to the goals of the Coordinated Undergraduate Program in Dietetics, independent study should be considered as an instructional strategy and learning experience.

Purpose of Study

The Department of Food Science and Food Systems Administration has introduced audiovisuals in some courses to facilitate lecture presentations and as independent study units in the form of minicourses. Limited research has been done to determine the effectiveness of audiovisuals in presenting materials which later must be transferred to actual situations as intellectual skills. The addition of a well equipped audiovisual laboratory has greatly stimulated interest in the possible applications of audiovisuals in independent study modules.

A department need could be met with an effective methodology for determining if the instructional strategy

for a particular subject matter is appropriate. The purpose of this research was to develop a methodology for determining if students in Food Systems Administration, through independent study, had met a desired mastery level in cognitive knowledge and intellectual skills for sensory evaluation of foods. The research was conducted using an audiovisual-tutorial unit with appropriate testing to determine the level of mastery of cognitive knowledge and intellectual skills. A limited attitudinal study was made to determine the student's attitude toward audiovisual media.

Importance of Unit

Quantity food production operations must strive to meet customer demands; therefore, food served must be acceptable from a customer's viewpoint. The maintenance and improvement of food quality in a food service system should receive more emphasis (David, 1973). Until quantitative methods of quality control are developed with wide application, the administrative dietitian has a major responsibility for food evaluation. This involves recognizing if a problem exists and correction of the error or malfunction to obtain a product of satisfactory quality in the future. Equipment to conduct objective sensory evaluation tests usually is not available; therefore, the dietitian must rely on subjective tests.

Basic Objectives

The following were the basic objectives for this study:

1. To develop an audio-tutorial minicourse on sensory evaluation of quantity foods for use in Food Systems Administration 3110, Quantity Food Procurement, Production and Service.

2. To develop test questions for use in determining a student's level of cognitive knowledge in relation to completion of the minicourse on sensory evaluation.

3. To develop performance activities for use in determining a student's ability to apply intellectual skills in relation to completion of the minicourse on sensory evaluation.

4. To determine the average attitude of students toward use of audiovisual media.

II. DEFINITION OF TERMS

Cognitive knowledge. Refers to the ability to recall facts, methods, processes, and generalizations in a form similar to that studied in the original learning situation (Hall and Paolucci, 1970).

Intellectual skills. Refers to the ability to apply the cognitive knowledge through mental processes of organizing and reorganizing the material to solve a problem (Bloom et al., 1956).

Instructional media. Refers to the material objects that provide vehicles for the communication of information. Media may be objects, events, language (printed and auditory), or pictures (Gagne, 1971).

Attribute. Refers to essential characteristics upon which judgment is made. The three attributes of quality in sensory evaluation are (1) appearance, (2) kinesthetics, and (3) flavor (Kramer and Twigg, 1970).

Factor. A specific subdivision of an attribute. For example, the factors of appearance are spectral, consistency, defects, size and shape, and wholeness (Kramer and Twigg, 1970).

CHAPTER II

REVIEW OF LITERATURE

I. APPLICATION OF EDUCATIONAL THEORY TO COGNITIVE KNOWLEDGE AND INTELLECTUAL SKILLS

Cognitive knowledge alone is an insufficient goal of education. Mere possession of knowledge (ability to recognize or recall) does not assure understanding or the ability to apply the knowledge. Understanding and application may, in some cases, accompany the possession of knowledge by some students, but the relationship is too imperfect to be relied upon when understanding and application are not purposely taught (Smith and Adams, 1972).

Intellectual skill implies that a student should have cognitive knowledge. However, the student should not stop with mere knowing, but should understand and apply the knowledge. A person cannot comprehend or apply the material unless the person knows the subject matter, neither can a person evaluate or analyze without knowledge. The development of intellectual skills in the use of knowledge may solve unforeseen problems in the future (Smith and Adams, 1972).

Retention of intellectual skills is greater than that of cognitive knowledge and tends to increase more after the teaching process ends. While knowledge is more limited in applicability, intellectual skills are applicable to all content areas and transfer of these skills to actual situations is much greater than that of knowledge (Smith and Adams, 1972).

A person retains little of what he sees and hears unless the material is used. Therefore, meaningful use of the material is a significant factor in continuing intellectual development fostered by permanent learning. When conditions of know-how, know-what, know-why and using are met, permanent learning is more likely to result (Dale, 1969).

II. INSTRUCTION

Instruction may be based on objectives or desirable outcomes of the instructional process. Mastery of objectives should indicate that the desirable behavioral changes have taken place. There are six major functions of instruction that apply to the learning of principles (Gagne, 1971). Learning can only occur when the student's attention is gained and maintained. Instruction must insure the recall of previously acquired knowledge while providing guidance to the student. Acquisition of knowledge must be followed by feedback at the appropriate time to let the learner know

which objectives have been met and where additional emphasis needs to be placed. Another essential function of instruction is the establishment of conditions for remembering and transfer of learning, such as spaced reviews and problem series. Finally, the outcomes of the instructional process must be assessed to determine the overall success of the instruction.

Learning theory states that when certain conditions are present, learning will occur and that learning is improbable when certain ones are not present. However, the learning theory does not specify an exact arrangement for the variety of instances to which the conditions are applicable.

Criticisms of Traditional Instruction

Traditional instruction or group-paced instruction is usually geared to the average student. However, people learn at different rates and in a variety of different ways (Kapfer and Swenson, 1968). Gagne (1971) believed that college instruction was often a perpetuation of tradition. College professors often structure courses in the same way the professors of previous years structured courses. The objectives often are established on the minimal set of readings or lectures to expose the students to the content.

Light (1971) stated that our culture is certificate-happy. The student was expected to take the bits and pieces

of information and memorize the facts, in order to acquire a diploma. Often these educational institutions stressed education rather than competence. When a student's education was completed and employment began, competence was the most important asset.

Changes Being Made in Instruction

Many other educational specialists have agreed with these criticisms of the educational system, and progress has been made. Beyers et al. (1972) said change is the idiom of our times. With this as a basis, the curriculum at the Evanston School of Nursing was redesigned to respond to the changing needs of the learners and the nursing profession.

The strengths of the program were recognized as well-defined content and competent instructors. The weaknesses involved academic routines which were designed without regard to individual learning rates and lack of cohesion between classroom and clinical experiences.

Content was arranged in modules according to levels of difficulty. Each module had written behavioral objectives which served as a basis for study guides and evaluation. The students were allowed to spend varying amounts of time on each module and complete the modules in any desired order. Mediated programs replaced the traditional lectures to convey the factual content. Learning activities such as patient

care experiences, seminars, printed materials and projects coordinated these facts with actual application. Each student was evaluated for cognitive knowledge by paper and pencil tests and for ability by self-evaluation guides and observations by the teacher.

Reich and Berman (1971) developed a programmed, self-instructional clothing course after considering the amenability of the subject to programmed instruction, the relation of the module to other units and cost. The basic idea of the new program was to allow each student to progress at individual speeds. Cognitive knowledge and the ability to apply the knowledge were measured by completion of a garment.

Wittkope (1972) reported on the use of mediated self-instruction at the College of Nursing at South Dakota State University. The instructional method was selected in order to allow more time for the teacher to guide the students, to more accurately follow the student's progress, and evaluate and correct student errors. The teacher did not have to repeat the same material as previously. The continuous improvement of the units increased the quality of the content presentation. Also, more time was available to learn to know the students.

Procedure for Development of Modules for Instruction

In adoption of any new instructional method, the subject matter must be evaluated to determine the adaptability of the content to the method. The effect on cost, time, and facilities also must be considered.

Objectives. The most important step in the development of a module is probably the formulization of instructional objectives. The behavior the student will be asked to employ to demonstrate mastery should be included in each general and performance based objective. The objectives should be exact. From the objective, the student should determine what, how and how much is to be achieved (Wilford, 1972).

Dalis (1970) utilized precise, vague, and placebo objectives in a health education program. The test scores indicated that the use of precise objectives enhanced achievement, whereas vague objectives deterred learning achievement. The test scores of the students using placebo objectives were only slightly lower than those with vague objectives.

Not only must objectives be formulated and written in exact and precise terms, the objectives must be presented to the students. Kapfer and Swenson (1968) suggested that objectives should be included in each module since students often move at varying paces. Sisler (1970) chose to retain

one lecture per week to introduce the unit and to provide question sheets for each laboratory section. Beyers et al. (1972) wrote behavioral objectives for each module to serve as a basis for study guides and evaluation. Objectives then were included in the student syllabus, since the faculty found that students function best with a definite modular framework.

Each program should have various techniques. Several may be used in one program, but in all cases, the objectives should be written, precise and exact, and presented to the student.

Preassessment. The second phase of instructional development is preassessment. After the objectives are written, test questions should be developed to correlate with the objectives. All questions must stem from the objectives, but all objectives do not have to be included in the pretest (Wilford, 1972).

Wilford (1972) stated that the three purposes of preassessment are to determine: the student's previous knowledge of the subject, if the student possesses the prerequisite behavioral capabilities necessary to complete the unit, and the instructional activities which are most adequate for the individual student.

Glaser and Nitko (1971) used the term "placement test," but the purpose of the test was the same as for a pretest. Pretests or placement tests are extremely important if a number of modules are in a tree-structured or linear structured sequence. In a sequenced instructional process each unit branches or stems from another, thus, mastery of preceding modules becomes a necessity. In such a sequence, a student may be able to eliminate some modules or review when necessary to continue the instruction.

Since the objectives define any prerequisite behavior and all expected behavior, the objectives determine the type, format, and purpose of the preassessment for any given module or unit of instruction.

Instruction. Subject matter should be examined to determine the appropriate method for presenting the material, traditional, independent study, or any combination (Reich and Berman, 1971).

If independent study proves to be the most favored choice, one method must be selected from the many which are available. In cases such as the one reported by Beyers et al. (1972) at a school of nursing, the class content and clinical practice had to be coordinated. In that program, mediated programs presented the factual information and visual media demonstrated the performance expected. The students then

used videotape to evaluate the performance of each other. The College of Human Medicine used a carrel with slides, films, and audio tapes followed by practice in a laboratory to teach laboratory techniques. Reich and Berman (1971) used programmed instruction with demonstrations to small groups when needed. No two programs can be the same if the subject matter and objectives are different; therefore, the instructional method must be the best for each individual program.

Evaluation. The final step in instructional development is evaluation or posttesting. Learning cannot be assumed to have taken place until assessment has been made of the changes that are produced (Lindvall, 1961). Evaluation should be based on changes in behavior in relation to objectives of instruction. Any evaluation without reference to such objectives is without direction (Anderson, 1965). Educational evaluation includes any procedure that appraises the extent to which specified educational objectives are achieved (Lindvall, 1961). Evaluation is not a rating of a student against the abilities of the rest of the group. Evaluation is an appraisal of the student's individual growth over a period of time. Therefore, pretests and posttests are equally important. Evaluation should be a valuable learning experience in itself. If the examinations are an

integral part of the teaching-learning process, examinations can be valuable learning experiences (Anderson, 1965). Evaluation should not imply the end of the instructional design unless the student has successfully indicated a working knowledge of the material presented. If the student does not have this working knowledge, some means should be available for the student to review and master the material. The most efficient instruction is one in which the students master as many objectives as possible (Wilford, 1972).

When an objective includes the terms "to be able to do" or has other intent for performance, skill, ability, or attitudes and appreciations, then tests that are closer to reality of the objective itself should be used (Kemp, 1971). According to Fritzpatrick and Morrison (1971), written tests can test for skills if a problem or simulation is presented to the student in such a way that rote memory can not assure correctly answering the question.

Test items designed to measure intellectual abilities and skills may be classified generally as the problem type. In a problem type test, the student is presented a problem to solve by utilizing the skill or activity that is expected in the objectives (Smith and Adams, 1972). This reality may be approached by several testing methods. Practical manipulation of objects, materials, or tools is one type of test which requires skill and knowledge. Audio recording

requiring identification or analysis of specific voices, descriptions, or situations utilize skills as does recognition or sequencing of steps in a process by using photographs or slides. Selecting correct procedures or reacting to problem situations with films or video tape recording is another method.

The above methods are best suited for testing individuals. Several individuals can be tested simultaneously by setting up a number of stations in a room. Each station has one question or problem with all the necessary equipment or materials. One student is assigned to each station and after a designated period of time, each student progresses to the next station. The process continues until all students have been to each station one time (Kemp, 1971). A testing situation with stations and rotation of students may be referred to as a practical examination.

A practical examination generally is used to evaluate the student's ability to apply intellectual skills. Knowledge is a prerequisite to intellectual skills; therefore, the practical examination may be an indication of knowledge as well as intellectual skills.

III. INSTRUCTIONAL MEDIA

Utilization of Instructional Media

In the classroom situation, application of knowledge often is impossible in that limited facilities and materials are available. Audiovisual media extend the horizon of experience by serving as a substitute for actual experience. Media can be a source of information, but media also go beyond the verbal symbol of printed medium to clarify difficult concepts and complex information through contrived experiences and simulated situations (Erickson, 1968 and Unwin, 1969).

Media tend to widen the range of student experiences. The student should have the ability to generalize but at the same time needs the capacity for applying the knowledge to a new situation. A student's capacity can be increased only by dealing with a wide range of new experiences (Dale, 1969).

Media are a part of instruction. In independent study, media may comprise the entire instructional process. When media are integrated into the traditional presentation method, the materials may be only a segment of the instructional process. When preparing to teach, the advantages of media must be recognized for appropriate utilization. The objectives of the unit must be outlined and the media

selected that will present or help present the subject matter in the most effective manner.

In 1956, Sands, the author of an audiovisual textbook, stated that teaching was a reciprocal communication between and among pupils and teachers. Learning is a social process; teaching is only instrumental to learning. Any auditory, visual, or tactile machinery can be used for guidance in an educational experience. These methods seem to facilitate the acquisition, the retention, and the recall of lessons learned, in accordance with the natural learning activities of a human being. Use of audiovisual techniques cannot change traditional instruction into a royal road to learning.

More than ten years later, Dale (1969) expanded these ideas stating that media tend to increase the student's motivation to learn. Media provide freshness and variety in presentations and seem to appeal to students with varied abilities and learning styles. Another advantage found was that media encourage active participation and may assure order and continuity of thought while widening the range of student experiences. When used with other instructional materials, media could improve the effectiveness of the materials.

Unwin (1969) stated that audiovisuals not only appeal to students but to teachers. Teachers use the media to improve communication and add interest. Media increase

motivation of the teacher as well as the student and gratify the teacher's liking for making and/or using the aids.

Similar advantages of media were reported by Dale (1970) who stressed that media do not make learning easy. Instead, media help students develop workable useful generalizations for later use.

While the use of audiovisuals may provide numerous advantages, to be effective, the materials must be used properly.

Media Selection

No artistic or best way of presenting a lesson exists. Adaptation of materials or methods to the specific person to be taught comprises the only true artistry (Dale, 1970). Gagne (1971) discussed several generalizations concerning the use of media. No single medium has special magic or all the properties that make it best for all purposes. The nature of the learning task should be the most important single criterion for a choice of medium. Matching specific instructional functions with appropriate utilization of instructional media was found as the best approach. A specific medium may perform one of the functions best at a given time while another medium may be best at another time. Various combinations of media may be more effective than a

single medium, but a combination is not necessarily superior to a single medium.

In media selection, all aspects of the instruction must be considered, especially the objectives or terminal behavior sought. Dale (1969) suggested asking the question "Why?" The "Why?" should be the foundation of the teaching process as well as the foundation for media selection.

IV. ATTITUDES

Attitudes, a person's tendency to behave in a certain way, may be affected by social pressures, specific characteristics, a particular situation, moral standards, emotions, or other complex elements. These attitudes are changeable as a person acquires knowledge or as the environment changes (Hall and Paolucci, 1970).

Attitudes have several dimensions which are important when measurement is desired. Direction is one dimension referring to whether a person is for or against the factor or subject being measured. Degree measures the extent of the direction. Measures of strength or intensity refer to the strength of the belief under consideration as compared with the person's other beliefs. The salience, or freedom with which one vents the attitudes, refers to the centrality of the attitude with the individual and cultural permissiveness. The coherent consistency of the attitude is a clue to

the ordering or integration of attitudes and how well the attitude is maintained under different situations.

A student's attitude will have an effect on the ability of the student to learn. If a student has a preconceived attitude about learning, the impediment or obstruction must be removed before learning can take place (Lewis, 1971).

Attitude and Independent Study Programs

Attitudes toward independent study programs have been assessed in a variety of ways. Each instrument developed has attempted to obtain a measure of the student's feeling toward the instructional method.

Reich and Berman (1971) developed a programmed, self-instructional program in a college level basic clothing course. Of the 30 students completing program evaluations, 27 students felt the program should be recommended for other students and 17 felt the programmed material moved at the proper speed and from the simple to complex. Nineteen of the students wanted other clothing courses with programmed instruction.

Sisler (1970) developed an audio-tutorial system for a beginning clothing course, which consisted of one weekly lecture, one quiz session and independent study in an audio-visual laboratory. The two- to three-hour weekly laboratory segments were composed of slides, filmstrips, and display

materials which the student utilized when convenient during the week. Of the 105 students completing the evaluation form, only 4 percent preferred the three-lecture-per-week system which had been used previously. Sixty-one percent preferred one quiz session and independent study laboratory without a lecture, and 27 percent favored complete individual instruction with laboratory segment only.

Of the 33 students participating in another self-instructional laboratory in a textiles course, 28 preferred the self-instructional laboratory over the lecture-demonstration method (Brandau, 1972).

Grant (1969) used the 22-item Kelley Audiovisual Attitude Scale to determine the attitude toward the use of audiovisual media. The scale was administered to secondary teachers in Wisconsin before visiting the Wisconsin Audio-visual Education Demonstration, and again after the visits. The two measures were used to determine the change in attitude and to aid in classifying the teachers as acceptors or rejectors of the newer educational media.

CHAPTER III

METHOD

Eighteen undergraduate student volunteers completed an audio-tutorial study unit on "Sensory Evaluation of Quality in Foods." A battery of tests were developed from two test question pools (Appendix A and B) to measure the level of students' cognitive knowledge and intellectual skills prior to study of the unit, immediately following the study, and four weeks later. In addition, each student completed the Kelley Audiovisual Attitude Scale (Appendix C) and a Student Information Sheet (Appendix D).

The results were analyzed to determine if a change in scores had occurred and the correlation of attitude to the test scores.

I. SELECTION OF TOPIC

Quantity Food Procurement, Production and Service, an introductory professional level course for all students in the Coordinated Undergraduate Program in Dietetics, covers a large number of topics discussed in general terms with a few specific areas of concentration. The laboratory portion of this course is conducted in an ongoing food production

system where the students meet one of the basic course objectives, the development of intellectual skills.

To determine how course content could be improved, several seniors who had taken the course the previous year were informally interviewed. The question "Which area do you feel should have received more emphasis in the quantity food production course" usually received the answer "quality control." One area of quality control that could demonstrate a student's ability to transfer cognitive knowledge to intellectual skills is sensory evaluation.

The purpose of the project was to develop a unit which would increase skills necessary to make subjective sensory evaluation of finished food products. Sensory evaluation of finished food products is not the only type of evaluation, but skill in recognizing errors in the final product is one aspect of the total evaluation process.

II. UNIT DEVELOPMENT

The content for the unit on sensory evaluation of quality was developed from Kramer and Twigg (1970), a major reference for quality control in the food processing industry. Since the concepts and principles of quality control are similar for all types of food production systems, only slight modifications were necessary to apply these basic concepts and principles to a food service system.

Applicable concepts and principles of sensory evaluation of quality were identified as appearance, kinesthetics, and flavor. These attributes and the factors of each one were then modified to apply to a food service system. Objectives and content were written and test question pools developed. The attributes and factors were visually depicted on 35 mm Kodacolor slides. These slides were arranged in a Carousel slide tray for use on a Kodak Carousel Auto-Focus 850 projector. The written narrative was recorded on a Sony cassette recorder with a "tone" inserted at appropriate intervals to indicate when the student should proceed to the next slide. The slide-tape series was made available to the students for a two-day interval between the pre and posttest. The script with notations for slides is presented in Appendix E.

Some of the slides depicted sample food items prepared incorrectly and/or correctly with explanations given on the tape. Others outlined definitions, lists and facts. No written outline or summary was provided to the student but note-taking was allowed.

The unit was planned for independent study. No assistance was offered by the researcher or requested by the students except when equipment difficulties arose.

III. SELECTION OF SUBJECTS

Subjects were required to be undergraduate students who had completed Food Systems Administration 3110, Quantity Food Production, Procurement and Service. Notices requesting volunteers meeting these criteria were posted at various locations in halls and on bulletin boards in the College of Home Economics. Several classes were also visited to inform students of the project. Follow-up contacts were made in person and by phone. Since the Food Science and Food Systems Administration Department is small, the names of the students meeting the criteria were easily obtained. Of these students, eighteen juniors and seniors participated in the project which was designed for Food Systems Administration students completing academic requirements for the American Dietetic Association. One student with a major in nutrition was accepted as a volunteer because the background courses were similar.

IV. TEST CONSTRUCTION AND SCORING

Evaluation of Cognitive Knowledge

Forty-five multiple-choice questions with four to five choices were constructed in groups of three. The questions were assessed by the research committee for validity and reliability. The groups contained questions to test the

same objectives, but each question was worded differently. Each of the three tests used consisted of one question from each of the fifteen groups. The subjects were instructed to circle the best answer. Each question had only one best answer worth one point, to give a possible score of 15. If several answers were circled, the item was scored as being incorrect.

Evaluation of Intellectual Skills

The practical examination was developed to determine the student's ability to apply intellectual skills associated with sensory evaluation of quality in foods. Various foods were prepared for service and presented at individual stations to be evaluated for acceptability. The student was allowed one and one-half minutes at each station at which time the subjects moved forward one station.

The first station had two food items with the answer sheet (Appendix F) instructing the subject to check the food of the "higher quality" or indicate if there was "no difference." Question number one had a value of one point.

Each of the remaining nine stations had one food item. The subjects were instructed to check the food as acceptable or unacceptable and write the attribute and factor which was the basis for judgment. Each of these questions had three possible points; one point for acceptable or unacceptable,

one point for the correct attribute and one point for the correct factor. Each point was scored independently of all the other points; one incorrect answer had no effect on the score for the additional parts to the question.

Several students chose to write a discussion or sentence instead of the one word for attribute or factor. Although one word was requested, if the explanation contained the correct word, the item was scored as correct. If the word was not included, the answer was scored as incorrect.

V. ADMINISTRATION OF TESTS AND MODULE

Contacts were made to schedule the most appropriate time for each student. Tests were administered in groups when possible, although some students completed the tests individually due to time conflicts.

On the first day each subject completed the Student Information Sheet, the Kelley Audiovisual Attitude Scale, and a multiple-choice pretest with no time limit. If a group took the test at the same time, the subjects who finished first waited so all students took the practical examination at the same time.

After completion of the forms and tests, each subject was instructed to view the slide-tape series as many times as necessary to comprehend the material. Note-taking was not encouraged or discouraged.

The posttests were conducted two days later using the same procedure as for the pretest. The subjects were informed at the time of the posttest of the retention test which was to be administered four weeks later. A majority of the students requested that contacts be made the week before the test to discuss the time schedules. The contacts were made and schedules were arranged so tests were again administered in groups when possible, although time conflicts dictated several subjects taking the tests individually. At this time, each student repeated the Kelley Audiovisual Scale, the third multiple-choice test for cognitive knowledge and the third practical test for intellectual skills.

VI. MEASUREMENT OF ATTITUDES

The Kelley Audiovisual Attitude Scale was developed by Kelley and used in the Wisconsin Audiovisual Demonstration Program. The scale consisted of 22 statements (Appendix C) which reflected a very positive or a very negative attitude toward the use of audiovisual media. The scale had previously been tested for validity and reliability. Each statement had a numerical index (Appendix C) of the attitude toward audiovisuals (Grant, 1969).

The students were instructed to check the items which expressed the individual's feelings toward the use of

audiovisual media. The scale had been developed for administration to teachers. None of the students in this study had any experience in teaching. Experience in oral presentations was the basis on which several students checked applicable items. The items with checks then were assigned the numerical value and averaged to obtain the mean attitude toward the use of audiovisuals.

CHAPTER IV

RESULTS AND DISCUSSION

Objective measures included three 15-item multiple-choice tests taken from the 45-item pool of questions (Appendix B) and three 10-item practical examinations taken from the pool of practical examination items (Appendix A). The subjective information was tabulated from the opinionated questions on the Student Information Sheet.

The objective tests were scored on a point basis, then averaged and compared by "t" tests and rank-order correlations. The items on the information sheet were tabulated and compared. The objective and subjective measures were then compared by rank-order correlations. The average attitude was determined from the Kelley Audiovisual Scale.

I. OBJECTIVE MEASURES

The individual test scores and changes between pretest scores and retention test scores are shown in Appendix G. The six tests were labeled as pretest (written), posttest (written), retention test (written), pretest (practical), posttest (practical), retention test (practical) hereafter designated as pretest (W), posttest (W), retention test (W), pretest (P), posttest (P), retention test (P).

Cognitive Knowledge

The written tests were scored. Fifteen was the total possible score. The pretest (W) scores ranged from 9 to 13 with a mean score of 11. The posttest (W) scores ranged from 7 to 15. The mean score was 11.5. The retention test (W) scores ranged from 7 to 14; the mean score was 10.8. When a Paired "t" test for difference was used, none of the differences were significant (Table I).

Intellectual Skills

The practical tests consisted of foods to be evaluated with a total possible score of 28. The pretest (P) scores ranged from 5 to 14 with a mean score of 8.5. The posttest (P) scores ranged from 6 to 27 with a mean score of 11.6. The retention test (P) scores ranged from 6 to 17 with a mean score of 10.0. When compared with a Paired "t" test for difference, Table 1, a significant difference was found between the pretest (P) and posttest (P) ($P \leq 0.10$), the posttest (P) and retention test (P) ($P \leq 0.20$), and the pretest (P) and retention test (P) ($P \leq 0.05$).

The positive change in scores seems to indicate that self-instructional media, for these students, did increase intellectual skills in quality evaluation of foods.

TABLE I

PAIRED "t" TEST FOR SIGNIFICANT DIFFERENCE IN INTELLECTUAL SKILLS AND COGNITIVE KNOWLEDGE IN SENSORY EVALUATION OF QUALITY IN FOODS

	Mean Difference	t-value	Probability
Cognitive Knowledge			
Pretest (W) and Posttest (W)	0.5	-1.05	N.S.
Posttest (W) and Retention test (W)	0.7	0.95	N.S.
Pretest (W) and Retention test (W)	0.2	0.21	N.S.
Intellectual Skills			
Pretest (P) and Posttest (P)	3.1	-2.06	.10
Posttest (P) and Retention test (P)	1.6	1.47	.20
Pretest (P) and Retention test (P)	1.5	-2.2	.05

Comparison of Two Tests

In comparing the two measures by rank-order correlations (Table II), no significant correlation coefficient was found between the pretest (W) and pretest (P) or between the retention test (W) and retention test (P). A significant correlation coefficient was found between the posttest (W) and posttest (P) ($P \leq 0.02$). Therefore, as the posttest (W) scores increased, the posttest (P) scores also increased. The results would indicate that cognitive knowledge and intellectual skills increased simultaneously.

The scores on the practical tests never exceeded the scores on the written tests. Application demonstrates a higher level of learning than knowledge in the hierarchy of educational goals; therefore, knowledge must be obtained before application (Bloom et al., 1956). The test scores indicated that knowledge was greater than application for all subjects in the sample.

Several students decreased the difference between the pretest and posttest scores, but a number did not. The researcher was aware that a few students did not utilize the unit, but the specific students who did not were not known. These students may be the ones who had no gain in test scores, but the extent of the effect of module utilization cannot be determined by the data.

TABLE II

RANK-ORDER CORRELATIONS OF INTELLECTUAL SKILLS AND COGNITIVE KNOWLEDGE IN SENSORY EVALUATION OF FOODS

	Correlation Coefficient	Probability
Pretest (W) Pretest (P)	0.11	N.S.
Posttest (W) Posttest (P)	0.58	0.02
Retention test (W) Retention test (P)	0.30	N.S.

Figure 1 shows the difference in average percent scores for the three sets of tests. This graph also shows that average scores on both the written and practical test increased immediately following the unit presentation, but decreased after four weeks. A decrease after a period of time without review was expected. The average retention test (P) score was above the average pretest (P) score. These results indicate that the intellectual skills tended to increase and such increase may be a result of the module.

The average practical test scores increased 16 percent from pre to posttesting then decreased 6 percent for a total increase of 10 percent. The average written test score increased 3 percent from pre to posttesting then decreased 4 percent for a total decrease of 1 percent. When comparing average test scores, the total increase in intellectual skills was greater than the increase in cognitive knowledge for these students.

The retention test (W) scores were lower than those on the pre and posttest (W) scores. The students completed the retention test during the final examination period. This variable may have affected the test scores. If the pressure of final examinations had an effect, the effect was less on practical application than on knowledge.

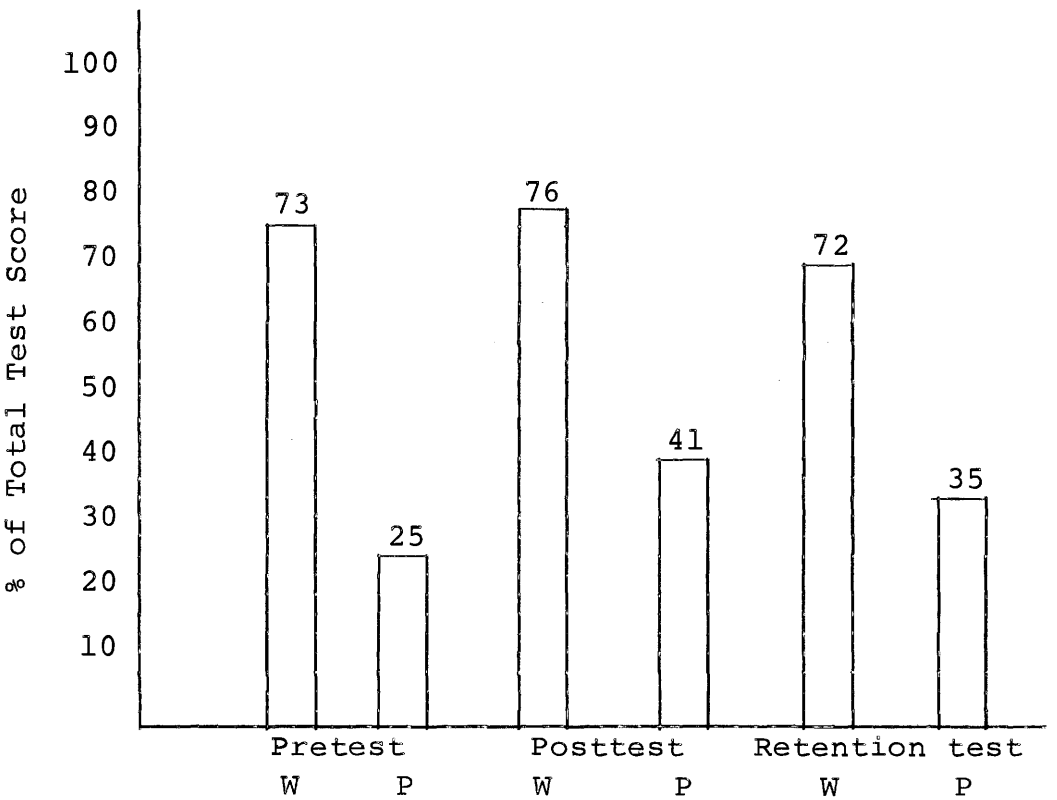

Figure 1. Average percent scores of three test sets measuring cognitive knowledge and intellectual skills in sensory evaluation of foods.

II. SUBJECTIVE MEASURES FROM STUDENT INFORMATION SHEET

The Student Information Sheet (Appendix D) was developed to obtain background information, experience, previous courses, major and pertinent personal information. The form also contained several opinionated questions related to instruction. The students were asked to rank teaching methods, test preferences, independent study preferences, and to rate instructional media. These rankings were tabulated and averaged to obtain an average student rank.

Ranking of Teaching Methods

Students were asked to rank a list of ten teaching methods assigning number one to the most preferred and number ten to the least preferred. The ten teaching methods and the average ranks are presented in Table III.

Lectures were ranked as the least preferred teaching method. Often lectures at a large university indicate large structured classes with little opportunity for individual instruction or provision for individual preferences. Student presentation of class projects was next in rank followed by student projects only, independent study with media, and small groups without a leader. The difference in average ranking of these four methods was relatively small, 1.3. The methods have less structure than lectures but

TABLE III

AVERAGE STUDENT RANKING OF TEACHING METHODS[a]

	Teaching Method	Average Rank
1.	Work experience	2.3
2.	Small group with teacher present	2.9
3.	Independent study with teacher present	4.6
4.	Teacher presenting a class with audiovisuals	4.7
5.	Small groups without a leader	5.6
6.	Independent study with media	6.0
7.	Student project only	6.2
8.	Students use their projects to present lesson each day	6.9
9.	Straight lecture with no audiovisuals	6.9
10.	TV lecture	8.7

[a]The teaching methods are arranged in descending order of preference.

direct teacher or leader guidance. The third and fourth methods in order of preference, independent study with a teacher and teacher using audiovisuals, had a difference of 0.1. These two methods stated that a teacher was present but the size group was not indicated.

The two most preferred methods were work experience and small groups with a teacher present. These two methods, 1 and 2, had a difference in average ranking of only 0.6, whereas the difference between methods 2 and 3 was 1.7. This difference between two teaching methods was exceeded only by the difference between methods 9 and 10 which were the lecture type.

The work experience to which these students had had exposure involved experience in an operation under the supervision of an instructor and/or experienced personnel. The instructors or personnel provided guidance and direction for students completing individualized work projects or work assignments. In most cases the goals were selected through cooperation and agreement by the student and the leader. The work usually was completed by the student, but assistance was available when needed or requested by the student.

The ranking of the teaching methods indicated that the students in the sample preferred methods involving a distinct relationship with the teacher. Although a lecture by a teacher was ranked ninth, TV lecture which usually infers no

teacher, was lower; the difference in average ranking of the two methods was 1.8, the greatest difference noted between any two methods. The preference for a teacher was indicated further in that independent study with a teacher present had an average rank exceeding that of independent study with media by 1.4. Since independent study with a teacher present did not remove the possibility of mediated instruction, the presence of a teacher may have been the differentiating factor.

The rankings seem to indicate that the students in this study preferred teacher contact on an individual basis in a less structured setting.

Testing Preferences

The subjects also were asked to rank six types of tests. Each type was subdivided into take-home and in-class tests to give 12 test variations. Number one designated the most preferred and number 12 the least preferred. The average student ranking of the 12 variations and the six types are presented in Table IV.

The average test preference rankings by the students indicated that both variations of the practical application test were the most preferred, followed by take-home projects. In-class objective tests ranked fourth in preference. Both variations of the practical test were ranked extremely low

TABLE IV

AVERAGE STUDENT RANKING OF CLASSROOM TESTS

Test Type and Variation	Average Ranking of Variation	Average[a] Ranking of Type
Practical Application		3.7
Take-home	3.7	
In-class	3.7	
Essay		5.2
Take-home	5.0	
In-class	5.5	
Projects		5.6
Take-home	4.4	
In-class	6.9	
Objective		5.7
Take-home	6.6	
In-class	4.9	
Paper		6.6
Take-home	5.4	
In-class	7.8	
Oral		7.5
Take-home	7.9	
In-class	7.1	

[a]Computed by averaging the two subdivisions.

or highly preferred, whereas the in-class project and take-home objective test were ranked considerably higher or less preferred than the other variation of the same type test.

The least preferred test variations were used the least in the Food Science and Food Systems Adminstration Department at the time of this questionnaire. Therefore, the lack of preference may be due to the lack of exposure to the techniques. Test variations least used included take-home and in-class orals, in-class papers, and in-class projects.

The most commonly used tests were take-home and in-class essay, take-home projects, in-class objective, and take-home papers. The average rankings of these tests, ranging from 4.4 to 5.4 clustered slightly below the mean of 5.7 for all the rankings. The most preferred practical test was used to some extent, but not as often as the other test types.

The ranking of teaching methods indicated that the students preferred individualized self-instruction with experienced leaders. The ranking of the test types also follows this pattern. Most practical tests and take-home projects are individualized and conducted under direct supervision of the instructor.

In general, the students did not show a preference for in-class or take-home tests. For this sample of students,

the test type had more influence on test preference than the test variation.

Independent Study Preferences

In checking the preferred independent study situation from a list of four types, three students preferred nonattenders classes, nine students preferred special projects, and one student checked both nonattenders and special projects bringing the totals to four and ten respectively. Five students preferred programmed instruction while none indicated a preference for slide-tape series.

The term "special project" was used most often to designate a project which is specially designed for a particular student, usually under the supervision of an instructor. As with the teaching method preferences and test preferences, the students preferred individualized assignments with supervision.

Instructional Media Ratings

Table V summarizes the results of student ratings of four instructional media as excellent, fair, or poor. Films were rated excellent by 12 students and fair by 6. Transparencies received 10 excellent and 9 fair ratings. One student checked both excellent and fair. Slides with narrations were rated excellent by 4 students, fair by 9 and poor by 4. One student did not rate this medium. Slides with

TABLE V

STUDENT RATINGS OF INSTRUCTIONAL MEDIA[a]

Student	Transparency	Films	Slide/ Narration	Slide-Tape	Average
1	3	2	1	1	1.8
2	3	3	1	2	2.4
3	3	3	1	2	2.2
4	3	3	2	2	2.5
5	3	3	2	2	2.5
6	2	2	2	1	1.8
7	2	3	2	2	2.2
8	3	2	2	1	2.0
9	3	3	3	3	3.0
10	3	3	3	3	3.0
11	2	3	2	2	2.2
12	3&2[b]	2	--	2	2.3
13	2	3	1	1	1.8
14	2	2	3	3	2.5
15	2	2	2	2	2.0
16	2	3	2	2	2.2
17	2	3	3	3	2.8
18	3	3	2	1	2.2
Average ratings	2.5	2.7	2.0	1.6	2.3

[a] 3 Excellent
2 Fair
1 Poor

[b] In computations 2.5 was used as the rating.

tape received 4 excellent ratings, 9 fair ratings and 5 poor ratings.

Ratings were weighted using 3 for excellent, 2 for fair and 1 for poor. Results indicated transparencies and films were preferred with an average of 2.5 and 2.7 respectively. The slides with narration had an average rating of 2.0 and slides with tape had an average rating of 1.6.

Two students rated all four instructional media as excellent, one student had an average rating of 2.8 for the media, 12 average ratings were between 2.0 and 2.5, and three student ratings were 1.8.

As with the other rankings and ratings, the students preferred instructional media which most often involved an instructor or assistant.

Previous Experience

Sixteen of the 18 students had or had had a job involving food. Eight jobs had required some contact with quality control. Eleven of the students stated that quality control had been included in at least one class. Of the eleven, ten students had received some training in quality control in Food Systems Administration 3110, Food Procurement, Production and Service. A relationship was not found between the test scores and on-the-job experience or exposure to quality control in class.

Student Comments

The attitude toward audiovisuals was high whereas the ratings on slide-tape series were low in all rating scales. Student comments showed that attitudes about this particular series were positive.

The researcher was working in a laboratory next door to the slide-tape series and overheard some of the comments. Some of the comments were made directly to the researcher who avoided answering any questions about the unit or the purpose of the research. These comments were recorded for comparison with the objective and subjective results. A majority of the students "liked" the pretest and written objectives on the slides. Several said the unit was more meaningful because each one "knew what to look for." One student preferred to have the objectives at the end of the unit or at the beginning and end both. The reasoning was for review purposes.

The two most common questions during the pretest were "What is quality control" and "What are attributes and factors." Rather than answering the questions, the students were referred to the slide-tape series. Another common comment made as the students completed the slide-tape series was, "Now I know the answer to my question."

These comments may indicate that students' attitudes are affected by the design of the module as well as by the method of presentation.

III. RESULTS OF KELLEY AUDIOVISUAL ATTITUDE SCALE

Table VI summarizes the two attitude measures and the attitude change. The average numeric values of the preattitude measure for individual students ranged from 0.26 to 2.64 with an overall mean of 1.51. The postattitude measure received individual average numeric values ranging from -0.92 to 2.68. The overall postattitude mean was 1.42.

The change in attitude ranged from -1.43 to 1.71 with an average mean of 0.09. The difference in the preattitude and postattitude values was not significant, but the rank-order correlation coefficient was significant ($P \leq 0.02$).

When the individual attitude means were compared to individual test scores, the correlation coefficient between the posttest (W) and preattitude was significant ($P \leq 0.02$). The preattitude also had a significant correlation coefficient when correlated with the difference between the pretest (W) and posttest (W) scores ($P \leq 0.05$) and the difference between the pretest (P) and posttest (P) ($P \leq 0.10$). No other significant correlation coefficients were found.

TABLE VI

INDIVIDUAL PRE AND POSTATTITUDE MEANS AND ATTITUDE CHANGE

Student	Preattitude	Postattitude	Attitude Change
1	0.26	-0.92	-1.18
2	2.37	2.68	0.31
3	0.92	1.48	0.56
4	2.12	1.54	-0.58
5	1.63	2.21	0.58
6	0.82	2.53	1.71
7	1.04	-0.04	-1.08
8	1.04	0.85	-0.19
9	1.07	1.46	0.39
10	2.50	2.31	-0.19
11	2.25	1.53	-0.72
12	2.64	2.33	-0.31
13	0.91	1.46	0.55
14	0.83	0.95	0.12
15	1.65	0.22	-1.43
16	2.36	2.09	-0.27
17	0.90	1.34	0.44
18	1.92	1.54	-0.38
Average	1.51	1.42	0.09

The significant correlation coefficient between the difference in pretest and posttest scores and preattitude seems to indicate that attitude had an effect on cognitive knowledge and intellectual skill increases. A student with a positive attitude toward the instructional medium would seem to have a greater increase in test score following the unit.

CHAPTER V

SUMMARY AND RECOMMENDATIONS

This study was designed to develop a methodology for the evaluation of an audio-tutorial independent study module designed to increase cognitive knowledge and intellectual skills required in sensory evaluation of food quality. The attitude of the students toward audiovisual media and student opinionated rankings of various instructional media and methods were also measured.

I. SUMMARY

Intellectual skills were measured by practical tests and cognitive knowledge by multiple-choice tests. A test-question pool was developed for each type of test. Test items were selected randomly from the appropriate pool to provide the necessary tests.

The test scores indicated that for these students intellectual skills increased more than cognitive knowledge and were retained longer. The increase in skill level can be attributed to use of the audiovisual-tutorial module. However, since the method of instruction was not compared to another method, the conclusion that audiovisual modules are a superior type of instruction cannot be made.

The subjective measurements consisted of student rankings and ratings of teaching methods and media. The ratings and ranks indicated that these students preferred independent study and test methods which are flexible to allow individual activities. But at the same time, the students preferred the presence of an instructor. In several instances, teaching methods without an instructor were ranked lower than the same method with instructors.

The same pattern was found in the ratings of instructional media. Transparencies and films usually involve an instructor and these media were rated higher than slide-tape series or slides with narration.

The students also preferred practical examinations which usually require an instructor. The students had a greater increase in score on the practical tests than on the written. This may indicate that the test methods can affect the test performance.

The attitude to audiovisual media was positive in all cases in the premeasurement; two had negative attitudes in the postmeasurement. In both cases the average attitude was positive.

The preattitude numeric mean had a significant correlation coefficient when compared to the postwritten test and to the gain between the pre and postscores on both

tests. Therefore, attitude may have an effect on learning for these students.

II. RECOMMENDATIONS

Based upon the results and findings of this study, further research in a classroom situation is recommended. For more depth in development of intellectual skills, additional modules should be developed in a linear sequence. A postevaluation form to be completed by the subjects would also produce additional student opinions about the particular module used in the study. These results could then be compared to the findings on the information sheet concerning teaching preferences. The form should include ratings of pretest, objective placement, and the test types used in the unit.

Validation of the test measures should also be a part of the research. The research may be further expanded to include a comparison of audiovisual modules to traditional instruction to determine the most effective method for increasing intellectual skills.

BIBLIOGRAPHY

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Anderson, V. E. 1965. "Principles and Procedures of Curriculum Improvement," p. 471. Ronald Press Co., New York, N. Y.

Beyers, M., Diekelmann, N., and Thompson, M. 1972. Developing a modular curriculum. Nursing Outlook. 20(10): 643.

Bloom, B. S. (ed.), Engelhart, M. D., Furst, E. J., Hill, W. H., Krathwohl, D. R. 1956. "Taxonomy of Educational Objectives. Handbook I: Cognitive Domain," David McKay Company, Inc., New York, New York.

Brandau, R. 1972. Spatial perception as a related factor in teaching pattern fit by two methods; self-instructional laboratory and lecture-demonstration. M.S. thesis, The University of Tennessee, Knoxville, Tennessee.

Dale, E. 1969. "Audiovisual methods in teaching," p. 108. The Dryden Press, New York, N. Y.

Dale, E. 1970. On audiovisual. Theory into Practice. 9(2): 101.

Dalis, G. T. 1970. Effect of precise objectives upon student achievement in health education. J. of Exp. Education. 39(2): 20.

David, B. D. 1973. Systems approach is key to success. Hospitals. 47(12): 80.

Erickson, W. H. 1968. Administering instructional media programs," p. 108. Macmillan Co., New York, N. Y.

Fiel, N. J., and Ways, P. O. 1972. Development of evaluation of self-instructional materials. Journal of Medical Education. 47(10): 822.

Fritzpatrick, R., and Morrison, E. J. 1971. Performance and product evaluation. In "Educational Measurement," ed. Thorndike, R. L. Vol. 1. p. 237. American Council on Education, Washington, D.C.

Gagne, R. M. 1971. Learning theory, educational media and individualized instruction. In "To improve learning: An evaluation of instructional technology," ed. Tickton, S. G. Vol. II, p. 61. R. R. Bowker Co., New York, N. Y.

Glaser, R., and Nitko, A. J. 1971. Measurement in learning and instruction. In "Educational measurement." ed. Thorndike, R. L. p. 625. American Council on Education, Washington, D.C.

Grant, A. D. 1969. A study of the personality characteristics of the acceptor and the rejector of the newer educational media among secondary teachers of Wisconsin. Ph. D. thesis, University of Wisconsin, Madison, Wisconsin.

Hall, O. A., and Paolucci, B. 1970. "Teaching home economics," p. 384. John Wiley & Sons, Inc., New York, N. Y.

Kapfer, P. G., and Swenson, G. 1968. Individualizing instruction for self-paced learning. Clearing House. 42(7): 405.

Kemp, J. E. 1971. "Instructional Design, a plan for course development," p. 39. Fearon Publishers Lear Siegler, Inc., California.

Kramer, A., and Twigg, B. A. 1970. "Quality control for the food industry," The Avi Publishing Co., Inc., Westport, Connecticut.

Lewis, J. Jr. 1971. "Administering the individualized instruction program." Parker Publishing Co., Inc., Nyack, New York.

Light, I. 1971. Challenging perceptions to the health team members. J. Amer. Dietet. Assoc. 29(1): 13.

Lindvall, C. M. 1961. "Testing and evaluation: An introduction," p. 4. Harcourt, Brace and World, Inc., New York, N. Y.

Reich, N. A., and Berman, M. L. 1971. Programmed course in basic clothing. J. Home Econ. 63(3): 185.

Sands, L. B. 1956. "Audiovisual procedures in teaching," p. 3. The Ronald Press Co., New York, N. Y.

Sisler, G. 1970. Student reactions of an audio-tutorial system. J. Home Econ. 62(1): 40.

Smith, F. M., and Adams, S. 1972. "Educational Measurement for the classroom Teacher," Harper & Row Publishers, New York, N. Y.

Unwin, D. 1969. "Media and Methods: Instructional technology in Higher Education," p. 207. McGraw-Hill, New York.

Wilford, D. 1972. Put a model in motion. School and Community. 58(8): 20.

Wittkope, B. 1972. Self-instruction for student learning. American Journal of Nursing. 72(11): 2032.

APPENDICES

APPENDIX A

PRACTICAL EXAMINATION TEST POOL FOR MEASURING INTELLECTUAL SKILLS IN SENSORY EVALUATION OF FOODS

1. Hamburger
   Jelly Sandwich

   Both products were of equal quality. The hamburger was fried with no additional ingredients. The jelly sandwich was made by spreading a commercial jelly on white bread and cutting it in half. Both items were arranged on a dinner plate.

2. Hamburger
   Cheese Sandwich

   The hamburger was fried with no additional ingredients. Sliced American cheese was placed between two slices of white bread to form a sandwich, then cut in half. The two items were placed on a dinner plate. Both products were of equal quality.

3. Hamburger
   Peanut butter sandwich

   The hamburger was fried with no additional ingredients. Peanut butter was spread on white bread to form a sandwich, then cut in half. The two items were placed on a dinner plate.

4. Cottage cheese on pear

A canned pear half was cut into cubes and placed in a small bowl. One scoop of cottage cheese was placed on top of the pear.

5. Flavored gelatin on pineapple

Canned chunked pineapple was drained and placed in a small bowl. A 2-1/2" × 2-1/2" × 1" square of gelatin was placed on top of the pineapple.

6. Grapefruit

The misshapen fruit was placed on a small plate.

7. Cookies

The cookies were commercially prepared shortbread cookies with chocolate rippled across the top. Each cookie was broken into four pieces and arranged two cookies per plate. Close observation was necessary to distinguish the cracks.

8. Apple

An apple with brown specks was placed on a small plate. The apple was not spoiled.

9. Cake

A commercial pound cake was sliced 1-1/2" thick. A knife point was inserted about one-fourth inch into the sliced side of the cake and twisted to form punctures. The cake was placed on a small plate with the defective side upward.

10. Tomato juice

Homemade tomato juice that had separated was poured into a glass and allowed to separate.

11. Apple

A red apple was pressed on the counter to bruise the surface without breaking the skin. The apple was then placed on a small plate.

12. Apple pie

A commercially prepared frozen pie was cooked according to package directions. The pie was cut so the crust crumbled.

13. Green peas

Frozen green peas were purchased from a local market and prepared according to package directions. The peas were spooned into a small bowl.

14. Broccoli

Frozen broccoli was purchased from a local market and cooked four times the recommended time. The broccoli was placed on a small plate.

15. Flavored gelatin with bananas

Gelatin dessert was prepared according to package directions just before it jelled bananas which had been allowed to set in the air were added. The salad was cut into two-inch squares and placed on a small plate.

16. Rice

Rice was cooked four times the recommended cooking time so it clumped. The rice was placed in a small bowl with a scoop.

17. Gravy

One tablespoon of shortening was heated in a skillet, two tablespoons of flour were browned in the shortening. Water was added to produce an extremely thick sauce. The gravy was spooned onto a small plate.

18. Pudding

Instant pudding was prepared according to package directions, except extra water was added to produce a very soft pudding. The pudding was portioned into custard cups.

19. Bread

Commercial loaf bread was allowed to remain at room temperature until a dry crust formed. The bread was placed on a small plate.

20. Potato chips

The potato chips were left overnight in a bowl at room temperature, put in a refrigerator one hour, then left at room temperature for another hour. Some of the chips were browner than desirable, but none were broken. The chips were placed on a small plate.

21. Cheese

American cheese was allowed to set at room temperature until it dried-out and became hard. The cheese was placed on a small plate.

22. Apple

The apple had an indention on one side due to improper growth. The apple was placed on a small plate.

23. Biscuits

Biscuits were prepared by a basic recipe then kneaded four times the recommended amount. The biscuits were cooked according to the recipe and two were placed on a small plate.

24. Crackers

Crackers were allowed to remain at room temperature until the crackers became stale and lost crispness.

25. Milk

Homogenized milk was left at room temperature until a soured odor appeared, but the milk was not curdled. The milk was poured into a glass.

26. Tea

Tea was prepared conventionally and allowed to stand at room temperature for four days until soured. The tea was poured into a glass.

27. Bread

White bread was placed in a plastic bag until it had a moldy odor but no mold was apparent on the bread. The bread was placed on a small plate.

28. Banana

The bananas were placed in the refrigerator, then left at room temperature for several hours. After the skin turned dark, one was placed on a small plate.

29. Toast

The bread was placed in an oven and allowed to brown almost to the point of burning. The toast was placed on a small plate.

30. Salad dressing

Salad dressing was placed in a custard cup and allowed to remain at room temperature until it produced a strong acid odor and a crusty-like surface.

ANSWERS TO PRACTICAL EXAMINATION TEST POOL

1. No difference
2. No difference
3. No difference

		ATTRIBUTE	FACTOR
4.	Unacceptable	Appearance	Wholeness
5.	Unacceptable	Appearance	Wholeness
6.	Unacceptable	Appearance	Shape
7.	Unacceptable	Appearance	Wholeness
8.	Unacceptable	Appearance	Defect
9.	Unacceptable	Appearance	Defect
10.	Unacceptable	Appearance	Defect
11.	Unacceptable	Kinesthetics	Hand feel
		Appearance[a]	Spectral
12.	Unacceptable	Appearance	Wholeness
13.	Acceptable	All	All
14.	Unacceptable	Appearance	Spectral
15.	Unacceptable	Appearance	Spectral
16.	Unacceptable	Appearance	Consistency
17.	Unacceptable	Appearance	Consistency
18.	Unacceptable	Appearance	Consistency
19.	Unacceptable	Kinesthetics	Hand feel

[a]Only if off color is distinctive.

		ATTRIBUTE	FACTOR
20.	Unacceptable	Kinesthetics	Hand feel
		Appearance[a]	Spectral
21.	Unacceptable	Kinesthetics	Hand feel
22.	Unacceptable	Appearance	Defect
23.	Unacceptable	Kinesthetics	Hand feel
24.	Unacceptable	Kinesthetics	Hand feel
25.	Unacceptable	Flavor	Odor
26.	Unacceptable	Flavor	Odor
27.	Unacceptable	Flavor	Odor
28.	Unacceptable	Appearance	Spectral
29.	Unacceptable	Appearance	Spectral
		Kinesthetics	Hand feel
30.	Unacceptable	Flavor	Odor
		Appearance	Spectral

APPENDIX B

MULTIPLE-CHOICE EXAMINATION QUESTION POOL FOR MEASURING COGNITIVE

KNOWLEDGE IN SENSORY EVALUATION OF FOODS

1. Quality is
   a. An aspect which differentiates individual units
   b. A consideration in purchasing only
   c. An expert's opinion of an item
   d. All of the above

2. Human error is a definite factor in
   a. Objective evaluation
   b. Subjective evaluation
   c. Neither one
   d. Both

3. Instruments or chemicals are used in
   a. Objective evaluation
   b. Subjective evaluation
   c. Both
   d. Never used in food evaluation

1. Which is of better quality?
   a. Caviar and wine
   b. Coke and potato chips
   c. Liver and onions
   d. Depends on who is eating

2. Most food service managers use
   a. Subjective evaluation
   b. Objective evaluation
   c. Both
   d. Usually neither one

3. In order for an evaluation to be made, the person
   a. Must be formally trained in evaluation techniques
   b. Must have access to a laboratory
   c. Must have special equipment for evaluation
   d. None of the above

1. Quality may be defined as
   a. The best form of a product
   b. The degree of excellence
   c. Factors which make a product good
   d. All of the above

2. Subjective evaluation may be
   a. Done by a panel of trained people
   b. Conducted with instruments or chemicals
   c. Affected by human error
   d. a and c

3. Objective evaluation is seldom made in a food service because
   a. It is very costly
   b. It is inadequate
   c. The personnel do not know how to do the evaluations
   d. All of the above

4. In a food service the simplest type of evaluation is
   a. Subjective
   b. Objective
   c. Neither is effective due to lack of equipment
   d. Either one can be used without difficulty

4. Quality evaluation is the responsibility of
   a. Administrator
   b. Dietitian
   c. Cook
   d. Any one associated with the food service

4. Quality may be measured
   a. Subjectively
   b. Objectively
   c. Both
   d. Neither

5. A food service manager is concerned with
   a. Appearance
   b. Kinesthetics
   c. Flavor
   d. All of the above

5. In evaluation of food, one should consider
   a. Appearance
   b. Flavor
   c. Kinesthetics
   d. All of the above

5. Sensory attributes include
   a. Appearance
   b. Kinesthetics
   c. Flavor
   d. All of the above

6. A smaller size product
   a. Indicates a lower quality
   b. Has no affect on quality
   c. Indicates higher quality
   d. Is not always an indication of quality

6. Wholeness refers to
   a. The size of the product or serving
   b. Number of broken particles
   c. Nutrient content
   d. Method of preparation

6. Sliced pineapple
   a. Is of a higher quality than chunked
   b. Is superior for some uses
   c. Decreases labor costs; thus, it is better
   d. All of the above

7. Sediments may be classified as a
   a. Defect
   b. Shape factor
   c. Separation of ingredients
   d. All of the above
   e. a and c

7. Defects include
   a. Size
   b. Bruises
   c. Extraneous specks
   d. b and c

7. Defects may be defined as
   a. Imperfections
   b. Presence of something that detracts from perfection
   c. Absence of something necessary for perfection
   d. All of the above

8. Color may be improved by
   a. Proper cooking techniques
   b. Addition of acid
   c. Addition of alkali
   d. None of the above

8. Spectral factors include
   a. Gel
   b. Flavor
   c. Toughness
   d. None of the above

8. Spectral factors are an index to
   a. Ripeness or spoilage
   b. Endpoint of cooking
   c. Storage and package conditions
   d. All of the above
   e. a and b

9. If a sauce is too thick or lumpy, it may be due to
   a. Improper measurement of ingredients
   b. Too short a cooking time
   c. Order of ingredient additions
   d. a and c

9. Consistency factors may be an index to
   a. The amount of ingredients
   b. The duration and amount of heat
   c. Manipulation techniques
   d. All of the above
   e. b and c

9. Consistency factors include
   a. Viscosity
   b. Spread
   c. Size
   d. All of the above
   e. a and b

10. Taste and odor may indicate
   a. Burning
   b. Storage conditions
   c. Ingredient content
   d. All of the above
   e. a and c

10. Hand feel is a measurement of
   a. Consistency
   b. Turbidity
   c. Gel
   d. All of the above
   e. None of the above

10. Kinesthetic factors include
   a. Hand feel
   b. Flavor
   c. Mouth feel
   d. a and c

11. Tough meat may be caused by
   a. Improper cooking
   b. Maturity of the animal
   c. Improper cutting
   d. All of the above
   e. b and c

11. Odor is a factor of
   a. Appearance
   b. Kinesthetics
   c. Flavor
   d. None of these

11. Flavor factors are evaluated by
   a. Taste
   b. Smell
   c. Feel
   d. a and b

12. Overripe fruit and vegetables are evaluated by
    a. Kinesthetics factors
    b. Spectral factors
    c. Wholeness
    d. a and b
    e. All of the above

12. In evaluation
    a. Each attribute should be evaluated separately
    b. Each product should be evaluated on all attributes before decisions are made
    c. Enough attributes should be considered to make an accurate decision
    d. All of the above

12. A dietitian should be able to look at a product and
    a. Immediately and accurately identify the problem
    b. Identify several possible reasons for the quality
    c. Discard it or serve it, without further investigation
    d. All of the above

13. Nutrient content
    a. Is not important in a food service
    b. Is important in hospitals only
    c. Should be at a maximum in all institutions
    d. All of the above

13. Quality of a product may be maintained by
    a. Proper supervision
    b. Training personnel
    c. Continuous evaluation
    d. All of the above

13. A good recipe is important in food preparation because
    a. It lists the directions step-by-step
    b. It reduces the level of training required by cooks
    c. It may be used as a check to determine the causes of inferior quality
    d. a and c

14. The degree of maturity of fresh fruits and vegetables may be determined by
    a. Texture
    b. Flavor
    c. Neither
    d. Both

14. Cooking may change the
    a. Kinesthetic factors
    b. Spectral factors
    c. Manipulation techniques
    d. a and b

14. Evaluation is
    a. Made at designated steps during preparation
    b. Continuous
    c. The detection of bad products so they can be disposed
    d. All of the above

15. In evaluation of a finished product, a good check is in
    a. Total preparation time
    b. Recipe utilization
    c. The education of the cook
    d. Quality of the serving dish

15. Evaluation includes
    a. The determining of good products
    b. Why a product is of a certain quality
    c. The determination of bad products
    d. All of the above

15. Quality evaluation is important
    a. To satisfy customers
    b. To maintain a labor supply
    c. In reducing costs
    d. a and c

ANSWERS TO MULTIPLE-CHOICE EXAMINATION TEST POOL

1.	a	d	b
2.	b	a	d
3.	a	d	a
4.	a	d	c
5.	d	d	d
6.	d	b	b
7.	e	d	d
8.	a	d	d
9.	d	d	e
10.	d	e	d
11.	d	c	d
12.	d	c	b
13.	c	d	d
14.	d	d	b
15.	b	d	d

APPENDIX C

KELLEY AUDIOVISUAL ATTITUDE SCALE

AND NUMERICAL INDEX

Social Security No._____

Instructions: Place a check in front of only those statements that you feel express your feelings toward the use of audiovisual materials.

Item No.		Statement
1.	3.43	Audiovisual materials are a wonderful aid to classroom teaching.
2.	3.15	Children retain longer the material that has been presented visually.
3.	2.98	The use of audiovisual materials makes for high levels of student interest.
4.	2.61	Audiovisual materials are useful in correcting erroneous concepts.
5.	2.43	Films and filmstrips are usually quite accurate as far as content is concerned.
6.	2.12	Obtaining the audiovisual materials that I want is usually quite a simple procedure.
7.	1.83	Films are usually in good repair when they are received.
8.	1.54	Audiovisual materials can be useful on occasion.
9.	.90	Audiovisual materials are available when they are needed.
10.	.52	The good and bad points about audiovisual materials balance one another.
11.	-.35	My use of audiovisual materials has been limited though I would use more of them if I could be sure of their value.

12. -1.15 I have nothing against the use of these materials, but I wonder just how useful they really are.

13. -1.54 It might be difficult for the student to handle abstract ideas if his experiences are limited to audiovisual materials.

14. -1.83 My instructors in college did not use audiovisual materials; why should I?

15. -2.11 Previewing films and filmstrips is always a chore.

16. -2.33 It is too much bother to request the materials far enough in advance to be sure of getting them when you want them.

17. -2.74 It is extremely difficult to locate appropriate audiovisuals materials.

18. -2.98 Students in higher grades are able to handle more abstract materials and do not need audio-visual teaching.

19. -3.31 It takes too much time to use audiovisual materials in the classroom.

20. -3.55 These materials seldom have much to offer in the classroom setting.

21. -3.89 Teachers are just entertaining the class when they use audiovisual materials.

22. -3.92 Learning how to use audiovisual materials is a complete waste of time.

APPENDIX D

STUDENT INFORMATION SHEET

Social Security No._____ Marital Status S M D

Classification Sophomore Junior Senior Graduate Age____

Major_____ Have you had a previous major? Yes No

Instructions: Circle the correct answer or check in the blank if provided.

1. Are you a transfer student? Yes No From Where?_____

_____

2. Which of the following courses have you had or are presently taking? Check all that apply.

Food Systems Administration			3110_____	When?
			4130_____	
			4140_____	
			4150_____	
			4530_____	
Food Science	1010_____		3510_____	
	2000_____		4000_____	
	2510_____		4010_____	
	3020_____		4530_____	
	4040_____	or	4710_____	
Nutrition	3000_____		4030_____	
	3410_____		4110_____	
	4010_____		4230_____	
	4020_____			
Chemistry	3310_____			
	3320_____			
	3330_____			

3. Have you ever had any course containing quality control?

Yes No If so, please list them. Briefly describe their content.

Were they at the University of Tennessee? Yes No

4. Do you or have you ever had a job involving food?
Yes No

Do you or did you have any contact with quality control?
Yes No If so, briefly explain.

Were you or are you now responsible for determining if a food should be served or not? Yes No

Were you or are you now in a position similar to

_____Waitress or Waiter
_____Cafeteria Server
_____Food Service Supervisor
_____Food Assembly Line
_____Other (Specify)

5. What position do you hope to hold in the future?

_____Dietitian
_____Research in industry
_____Nutritionist
_____Teacher
_____Food Evaluation and/or inspection
_____Other (Specify)

6. Which of the following teaching methods do you prefer in the college classroom? Number in order of preference (Number 1 is the most preferred, 10 is the least preferred).

_____independent study with a teacher present
_____independent study with media
_____teaching presenting a class with audio visuals
_____straight lecture with no audio visuals
_____small groups with a teacher or experienced group leader
_____small groups without a leader
_____TV lecture
_____Student project only
_____Students use their projects to present lesson each day
_____Work experience

7. Which of the following instructional media do you prefer in a college classroom?

Media	Excellent	Fair	Poor
Transparencies			
Film			
Slides with narration			
Slides with tape			

8. In an independent study situation, what do you prefer?

_____Programmed instruction
_____Slide-tape
_____Special projects
_____Nonattenders classes

9. Why do you think teachers use audiovisual materials?

10. Which type of college classroom test do you prefer? Rank in order of preference (1 is most preferred).

	Take Home	In Class
a. Essay	_____	_____
b. Objective	_____	_____
c. Oral	_____	_____
d. Practical Application	_____	_____
e. Paper	_____	_____
f. Project	_____	_____

**Make any comments on back.

APPENDIX E

UNIT CONTENT

The objectives of the unit on sensory evaluation of quality in food are: (Slide 1)

1. The student should be able to define quality.
2. The student should be able to compare and contrast the types of evaluation.
3. The student should be able to recognize the three sensory attributes.
4. The student should be able to recognize the four appearance factors and their implications.
5. The student should be able to recognize the kinesthetic factors and their implications.
6. The student should be able to recognize the flavor factors and their implications.
7. The student should be able to recognize the relationships of all the sensory attributes and their evaluations.

A simple definition of quality is the degree of excellence. (Slide 2) Some people may think of a quality product as one that is expensive in nature, but in reality quality is what society decrees it to be not what experts decide is quality. A peanut butter and jelly sandwich may be of just as high a quality as steak and wine. (Slide 3)

Quality is an aspect, attribute, characteristics, or fundamental dimension which differentiates individual units and has significance in determining the degree of acceptability of that unit by the customer.

Quality may be measured subjectively or objectively. (Slide 4) Subjective evaluation is done by a panel of people or an individual with a knowledge of the desirable product. (Slide 5) Objective evaluation utilizes instruments and/or chemicals. It is free of human error and more likely to provide identical results, but it is expensive and often unavailable.

When a dietitian, food service manager, or anyone associated with a food service evaluates food items for quality, he must use the natural senses—sight, touch, smell, taste—because panels and instruments are unavailable.

The sensory attributes which represent sensory quality are easily subdivided into three overlapping groups— (Slide 6) appearance, kinesthetics, and flavors. Appearance factors appeal to the eye and are judged by the sense of sight (Slide 7) These factors include (1) size, shape, and wholeness (2) defects (3) spectral and (4) consistency.

Size, shape, and wholeness facilitate cutting, peeling, and blending. (Slide 8) Broken or misshapen fruits and vegetables are less attractive and more difficult to prepare.

(Slide 9) One slice of fruit requires less time to arrange in some salads than several pieces; thus, reducing labor time and cost. But cutting sliced fruit to combine with other ingredients increases time and cost. Therefore, the proper size, shape, and wholeness depends on the intended use.

(Slide 10) Defects may be defined as any imperfections due to the presence of something that detracts from perfection or the absence of something necessary for perfection. (Slide 11) Defects may be damages, bruises, extraneous specks, or sediments. (Slide 12) Bruised fruit and vegetables are not appealing to the customer, (Slide 13) if the spots are removed as in this apple, waste and labor time increases costs plus another defect may be produced. (Slide 14) Gravy, custard, or meringue that has a separation of fat or water may be considered unappealing. It is difficult to see in this dish but by close observation you can detect it at the bottom. Not only must the defect be recognized, it must be corrected and prevented in the future. Supervision of production enters into the continuous evaluation of products from receiving to service.

(Slide 15) Spectral factors include gloss, turbidity, transparency and color. These may be an index to ripeness or spoilage, endpoint of cooking, storage and package conditions. (Slide 16) If fruit or vegetables are dark, they may

have been overcooked or left out in the air too long prior to cooking. (Slide 17) In this case, the color indicates an inferior product but further examination of the color and/or a check on conditions of preparation and storage is required to penpoint the problem. (Slide 18) Most people agree that snap beans, peas, greens, etc., should be bright green, if they are not, the quality is lower. Overcooking or addition of acid can make the item a dull, dark green, while alkali produces a very bright artificial green color. Alkali also destroys the vitamins, thus, lowering the nutrient content—an important aspect for any food service. Therefore, a spectral change like any other change does not point out any one problem, it can indicate a number of differences. But once the difference is detected, a knowledge of the possible causes will narrow it to one or two and elimination will point out the correct one.

(Slide 19) Consistency factors include viscosity, gel, flow, and spread. They may be an index to the amount of ingredients, duration, and amount of heat or manipulation, a sauce that is too thick or thin can be due to any of these factors. (Slide 20 and Slide 21) A good place to begin checking is in the recipe and its use, (Slide 22) if it is supposed to produce a certain amount and did not the ingredient content may be the answer—improper measurement due to utensils or carelessness. The proper cooking time compared

to the actual cooking time is an indicator as well as the type and length of beating or stirring. A lumpy mixture may result from incorrect addition of ingredients. (Slide 23) Sticky or lumpy grain products are not as appealing as ones with separate units. Starch dissolves in cold water; therefore, a starch food should be placed in hot water at the beginning of the cooking process to prevent adhering of particles. Evaluation is not merely determination of good or bad, it includes why.

(Slide 24) Kinesthetic factors are concerned with the sense of touch—mouth and hand feel. If fruit or vegetables are too soft, they may be bruised or overripe. Bruises are usually present when softness and discoloration are both evident, while overripe items may be soft or grainy only. Tough meat may be due to poor purchased quality—cut wrong or too mature—but cooking conditions also have a pronounced effect. Cooking too fast or too done produces tough meat, again compare the recipe or suggested cooking directions and the actual procedure. Grainy or soft frozen dairy products may indicate improper storage conditions such as thawing and refreezing or improper temperature setting.

Flavor factors are judged by taste and smell; (Slide 25) they include odor, taste, and off-flavor. Off-flavor and odor are unappealing in themselves, but they usually indicate other problems—burning, incorrect ingredients or amounts,

improper storage (spoilage). Often they coincide with color or feel as in spoiled fruit, but soured milk looks the same and old bread often smells before the mold actually appears. As with all factors, flavor and odor are important in themselves, but the problems they indicate may be even more important.

Now, for a review "What are the sensory attributes and their factors?" (Slide 26)

APPENDIX F

PRACTICAL—ANSWER SHEET

Social Security No._____

1. Which is the best esthetic quality?

_____Meat
_____Sandwich
_____No difference

2. _____Acceptable
_____Unacceptable
Attribute Factor

3. _____Acceptable
_____Unacceptable
Attribute Factor

4. _____Acceptable
_____Unacceptable
Attribute Factor

5. _____Acceptable
_____Unacceptable
Attribute Factor

6. _____Acceptable
_____Unacceptable
Attribute Factor

7. _____Acceptable
_____Unacceptable
Attribute Factor

8. _____Acceptable
_____Unacceptable
Attribute Factor

9. _____Acceptable
_____Unacceptable
Attribute Factor

10. _____Acceptable
_____Unacceptable
Attribute Factor

APPENDIX G

TABLE VII

INDIVIDUAL TEST SCORES AND DIFFERENCE IN RETENTION AND PRETEST

Student Number	Pretest		Posttest		Retention Test		Retention/Pretest Difference	
	W	P	W	P	W	P	W	P
1	10	9	10	5	11	8	1	-1
2	10	8	12	6	9	7	-1	-1
3	10	9	11	8	13	7	3	-2
4	9	10	12	15	12	12	3	2
5	12	6	11	14	13	7	1	-1
6	9	10	10	8	11	8	-2	1
7	11	8	12	5	7	8	-4	0
8	11	8	12	7	12	6	1	-2
9	12	8	11	19	12	17	0	9
10	11	8	15	27	9	14	-2	6
11	11	12	12	14	11	13	0	1
12	10	8	11	9	12	10	2	2
13	12	8	7	7	10	10	-2	2
14	11	8	10	10	10	10	-1	2
15	13	7	13	11	12	12	-1	5
16	12	5	12	5	7	6	-5	1
17	13	14	12	17	14	15	1	1
18	11	7	14	23	11	11	0	4
Average	11.0	8.5	11.5	11.6	10.8	10.0	-0.3	1.6

VITA

Cynthia Sharaphane English was born in Tipton County, Tennessee, on August 24, 1950. She attended Gilt Edge Elementary School and was graduated from Munford High School in 1968. The following September she entered The University of Tennessee, Martin. After three years, she transferred to The University of Tennessee, Knoxville, and in August, 1972, she received a Bachelor of Science degree in Food Science and Institution Administration. She immediately enrolled in graduate school and received a Master of Science degree in 1974. She is a member of Omicron Nu.

Upon completion of academic courses Fall, 1973, she accepted employment in the Dietary Department of Jackson-Madison County General Hospital, Jackson, Tennessee.